GULF COUNTY RESTORE ACT PROJECT PRE-PROPOSAL FORM

Project Name: **Acoustic Telemetry Study and Data Analysis to Monitor Reef Fish Species Movements in the Gulf of Mexico Offshore of Gulf County, Florida**

Submitting Entity: **Science Applications International Corporation**

I. *Please select one or more eligible activity that the project is classified under:*

X *Restoration and protection of the natural resources, ecosystems, fisheries, marine and wildlife habitats, beaches, and coastal wetlands of the Gulf Coast region.*

X *Mitigation of damage to fish, wildlife and natural resources.*

X *Implementation of a federally approved marine, coastal or comprehensive conservation management plan, including fisheries monitoring.*

O *Workforce development and job creation.*

O *Improvements to or on State parks located in coastal areas affected by the Deepwater Horizon oil spill.*

O *Infrastructure projects benefitting the economy or ecological resources, including port infrastructure.*

O *Coastal flood protection and related infrastructure.*

O *Planning assistance.*

O *Promotion of tourism and seafood in the Gulf Coast region.*

II. *Please provide an executive summary of the project. Describe/quantify the economic (jobs, infrastructure, tourism, etc.) and environmental benefits (habitat, quality, knowledge, long-term sustainability, etc.).*

Project Summary

This project consists of tagging economically important reef fish species in the Gulf of Mexico with acoustic transmitters and monitoring their movements utilizing stationary hydrophone receivers deployed offshore of Gulf County, FL. A variety of species, including groupers, snappers, and jacks from varying age classes would be tagged and monitored. Detection data downloaded from the receivers would be imported into a software tool called Eonfusion® which specializes in 4-D visualization of acoustic telemetry data and analyzing multiple types of datasets that are otherwise too complex to complete using any other geospatial analysis software.

The results from this project would provide insight into reef selection preferences, habitat utilization, and site fidelity for reef fish species. It would also determine the relative suitability of

current artificial reef designs and configurations compared to natural reef areas. By monitoring movement patterns around a variety of natural and artificial reef habitats (i.e., culverts, concrete rubble, chicken transport devices, shipwrecks, etc.) and configurations, environmental managers and regulators will gain a better understanding of how these important reef fishes behave in this area of the Gulf of Mexico. Comparing fish movements from different reef designs and configurations will answer the question of how fish are utilizing the reefs that are currently in place. Managers and regulators need to know and understand the current status and behavior of reef fish of all age classes in our local area so they can plan effectively for the future.

The information gained from conducting an acoustic telemetry study over a natural and artificial reef network in the Gulf of Mexico will not only supplement findings from other research, but it will also provide continuous long-term monitoring of tagged reef fish, adding another level of groundtruthing that cannot be captured in random SCUBA diving observations or running models. These results will give concrete evidence that can be used in making decisions or resolving issues surrounding recreational and commercial use of natural and artificial reefs and overall fisheries management. The end goal is that the findings of this research will improve not only the status of our local seafood and tourism industry but also the ability to make informed decisions for long-term sustainable fisheries management.

Background Information

Applying artificial reef deployment as a component of fisheries management is a relatively new and poorly understood concept. Artificial reef programs are typically managed at the county or municipal level and are primarily tied to either recreational/commercial fishing or recreational diving interests. Any improvement to regional fishery population dynamics is incidental and not well-documented. In an effort to tie these two components together Florida Gulf Coast counties are attempting to manage their artificial reef programs in a manner that will fit stakeholders' needs while at the same time providing for the conservation of reef fish species. It is understood on the management level that in order for our local economy to continue reaping the benefits that commercial/recreational fishing and diving, the survival of our regional reef fisheries stocks is essential. Collaborating with state/federal regulators, scientists, and local fishermen and divers, artificial reef coordinators must be able find solutions that will benefit and satisfy all the key players.

Currently, there is a substantial lack of understanding on how artificial reefs affect fish community dynamics and population (Campbell et al., 2011). In order to successfully identify solutions associated with natural resource management, decision-makers must be equipped with the best science available and an understanding of how to apply it to local stakeholders' concerns. Currently, the commercial and recreational fishing industries are governed by quotas, size limits, and seasonal restrictions based on scientific data that does not provide a complete and accurate picture of the fisheries in this area of the Gulf. The scope of fisheries management has been narrowly focused on estimating the balance between fishery mortality with natural mortality. These calculations do not take into account how artificial reef deployment may or may not contribute to a fishery's stock assessment because there is no scientific data to support that correlation. This lack of data makes it impossible incorporate artificial reef deployment as part of

a sustainable fisheries management plan, which impacts how recreational/commercial fishermen and divers use this area of the Gulf.

Approach

SAIC is proposing to bridge this gap in knowledge by utilizing cutting-edge technology in studying important marine species and conducting sophisticated data analysis which will provide the best scientific data available that can be applied to artificial reef management decisions. Recent significant insights into the migratory habits of marine fishes have been gained from electronic tagging. Long-lived acoustic tags, which are detected by an array of strategically placed hydrophone receivers, offer the potential to estimate and monitor behavior and movements of a variety of fish species in their marine environment. In addition, the long life (three to five years) of these tags offer the additional prospect of generating information on demographic rates, such as reproductive periodicity and survival (Erickson and Webb, 2007).

Once the acoustic telemetry data are gathered, SAIC will analyze the data using state-of-the-art software that contains a wide range of applications. Perhaps one of the most useful components of this program is the ability to visualize the data in 4 dimensions that will clearly show the status of each reef type in relation to the rest of the study area. This visualization component is a powerful tool in presenting study results in a way that can be readily understood by the many stakeholders in the artificial reef program and by the public through forums such as tourism development websites. The software also has the capability to perform complex calculations with large amounts of data that can supplement fishery stock assessments.

III. Please provide a cost summary/budget. Detail any matching/cooperative funds available for use, and any cooperative support from governmental or other agencies.

A detailed budget is shown in the table below. It is important to note that while initial investment costs are relatively high due to the need to purchase costly technical equipment, it would be considered a one-time investment. The overall project costs rapidly decrease and level-off from Year 1 to Year 2 and then stabilize for subsequent years of study. This is important because collecting data over multiple years provides validity and statistical soundness to the data and to account for any anomalies due to weather phenomena or other factors. Table 1 below provides an example of how cost decreases and then stabilizes for this particular proposal. The following table assumes project will fund the purchase of 35 receivers, 100 tags for Year 1 and an additional 50 tags for Year 2.

**Table 1. Proposed Budget for a Multi-Year Project**

Year 1				Year 2		
Task	**Title**	**$000s**		**Task**	**Title**	**$000s**
1	Project Management Plan	$ 10		1	Project Management Plan	$ 10
2	Telemetry Receivers and replacement batteries (one time purchase)	53		2	Telemetry Receivers	0
3	Tag purchase	36		3	Tag purchase	18
4	Tag Deployment	50		4	Tag Deployment	25
5	Data downloads and maintenance	26		5	Data downloads and maintenance	26
6	Data analysis and final deliverables	60		6	Data analysis and final deliverables	60
Total		**$235**		**Total**		**$ 39**

IV. Please provide a timeline for project completion. Explain the technical and environmental feasibility (including any permitting considerations) of the project.

SAIC proposes to complete this project in four phases and are described as follows:

Task 1: Tagging – Begin purchasing equipment immediately after award. Complete 60 days after award.

A variety of reef fish species including snapper, grouper, and jacks would be tagged on public reefs using local charter boats and/or SAIC vessels. Tagging efforts would be led by a Senior Biologist with experience in surgically implanting tags into these targeted fish species. A team of scientists would support this effort by collecting relevant data including fork length, total weight, and species. Tagging efforts would focus on fish across a range of life stages for each species (e.g., 10 fish <38 cm; 10 fish from 38-50cm; and 10 fish >50cm for red snapper). Dependent upon availability, scientists would attempt to tag a sufficient number of each economically important species (red snapper, red grouper, gag grouper, scamp grouper, amberjack, etc.) and monitor their movements.
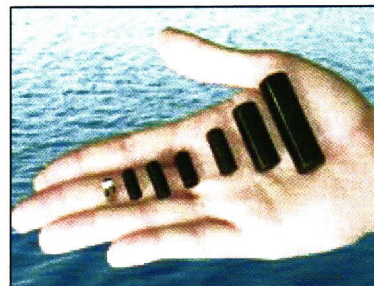
Task 2: Acoustic Telemetry Network Deployment – Begin purchasing equipment immediately after award. Complete deployment 60 days after award.


An extensive array of approximately 30 VEMCO VR2W receivers would be placed in areas near known artificial reefs and natural ledges or hardbottom areas. The configuration of the array would be strategically determined to include reefs of varying characteristics and would incorporate multiple factors such as: distance from natural reefs, distance from adjacent artificial reefs, reef density in a given area, size of artificial reef (wreck vs. grouper ghetto), and water depth. All of these variables would be mapped in a GIS application and stored in a database to be used during the data analysis phase of the project. The

VR2W receiver array would then be deployed at the selected locations. In addition, approximately three to five sentinel tags would be deployed in the study area for the duration of the project. These sentinel tags would be placed at various distances from selected receivers as part of a range test. Given the highly variable weather conditions in the Gulf, we have found that high sea states will impact a receiver's ability to detect a tag at longer distances. This concurrent range test will validate the receivers' ability to detect the tagged reef fish and will play an important part in the data analysis.

Task 3: Data Download and Array Maintenance – Complete 300 days after award.

Detection data would be downloaded from the array approximately every six weeks throughout the year. Data is collected via a Bluetooth wireless download, and imported into the VUE program where it can be organized and exported into Excel or other databases. These download trips would also be used to maintain the array to ensure all receivers are intact and functioning properly. Each buoy would be marked with the Project Manager's contact information in case they wash onshore. Replacement receivers may be deployed as needed to account for missing or damaged units from major storm events or boat strikes. Approximately three to five receivers would be set aside as reserves for this purpose only.
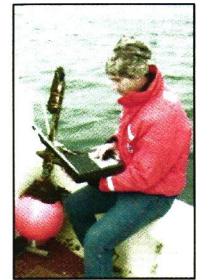
## Task 4: Data Analysis, Final Report, Recommendations, and Other Deliverables – Deliver 360 days after award
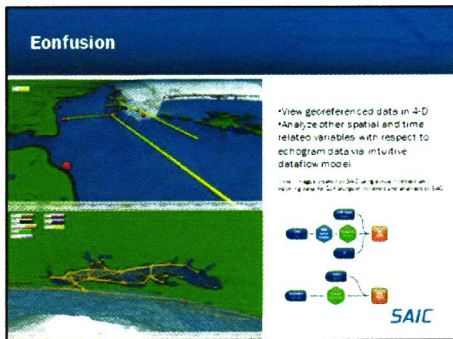
At the end of the data collection phase, detailed analysis would begin. Telemetry data would be imported into the Eonfusion® software, along with shapefiles of the study area, and other related environmental data. Experienced scientists would use the program to fuse all the datasets together to visualize the data and perform a variety of calculations based on species, age classes represented in the sample, and identify movement patterns and habitat utilization. Correlations between environmental factors and reef types could then be proposed and statistical analysis would validate the results.

Once the analyses are complete, the findings would be compiled into a final report with recommendations on management decisions and potential suggestions for future studies. The Eonfusion® software also has the capabilities to produce videos which can be uploaded into presentations or websites for easy visualization of the data and analyses performed. In addition, presentations or briefings can be generated and given at workshops, public meetings, or other conference or gathering of stakeholders.

V. Please provide the qualifications of the Submitting Entity, the financial feasibility/sustainability and the economic feasibility and sustainability of the project (probability of success, etc.).

SAIC's Qualifications

SAIC's marine scientists have decades of combined experience in both marine and terrestrial natural resources research and species management. The proximity of our Shalimar office to multiple marinas provides easy access to the Gulf of Mexico, Choctawhatchee Bay, Pensacola Bay, and Santa Rosa Sound. Given this ideal work location, many of our employees enjoy and participate in the activities the Gulf Coast has to offer and therefore have a vested interest in the conservation and management of our priceless local natural resources as well as the economic sustainability of our seafood and tourism industry. SAIC has an excellent reputation in working with the U. S. Fish and Wildlife Service, the National Marine Fisheries Service, the Department of Defense, and State and local agencies.
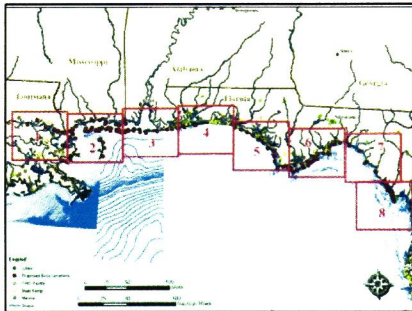
SAIC, on behalf of the Eglin Natural Resources Section was the first entity to use acoustic telemetry to investigate the movement and behavior patterns of the federally protected Gulf sturgeon in the Gulf of Mexico. Prior to this study, sturgeon movements in the marine environment was completely unknown, which made it difficult for the Air Force to receive permits to conduct important testing and training missions in the Gulf. In 2009, Eglin received funding from the Department of Defense Legacy Resource Management Program to conduct this two-year study. Between 2008 and 2010, approximately 120 adult Gulf sturgeon were implanted with VEMCO V16 acoustic transmitters and 20 VEMCO VR2W receivers were deployed in the riverine, estuarine, and marine areas surrounding Eglin Air Force Base. The array was in place from 2009 through 2011, providing continuous monitoring of Gulf sturgeon movements and annual migration cycles. The important data received and overall success of this project made SAIC the leading expert in studying marine species movements in this region of the U.S.

From 2010 to 2012, based on the experience gained from Eglin's study we partnered with the USFWS in completing a 2-year acoustic telemetry study tracking Gulf sturgeon movements in the Gulf in response to the Deepwater Horizon oil spill. Funded by the Natural Resource Damage Assessment (NRDA), this study involved the construction and deployment of approximately 150 VEMCO VR2W receivers from the west bank of Lake Pontchartrain to the Florida "Big Bend" near Cedar Key, FL and tracked nearly 500 adult Gulf sturgeon implanted with VEMCO V16 tags. Our team of marine scientists downloaded the entire array every six weeks and provided preliminary data analysis and valuable updates to the USFWS Project Manager.

This expansive array generated over a million lines of detections and researchers were finally able to capture the entire Gulf range of sturgeon movement during the winter. The cumbersome task of sorting through and analyzing the data, specifically for the Eglin Natural Resources Section, provided a new challenge. In 2012, SAIC acquired a revolutionary analysis tool, Eonfusion®, to visualize and analyze the massive amounts of telemetry data accumulated from monitoring Gulf sturgeon for three years. As a result, SAIC has tapped into a higher level of data analysis that fuses multiple data sets and formats together to create 4-D visualization (space and time) and perform complex calculations that would otherwise be impossible to do in just one program. It is hoped that this software application will lead to the enhanced management of protected marine species and aide in collaboration efforts with Federal/State agencies, researchers, and natural resource managers.

Based on SAIC's prior successes in implementing this technology for the study of marine species in the Gulf of Mexico, SAIC has demonstrated that the scientific sustainability and financial feasibility to complete the project within the proposed budget is high.

Study Scope and Cost Reduction

The project is economic feasibility of this project is also high in that the scope of the study can be tailored to fit specific data needs. For instance, a particular species may be targeted or a smaller or larger area may be surveyed. The up-front costs represent a significant portion of the overall costs of the project. The acoustic receivers are the most expensive component due to the high cost of the equipment as well as the construction of the anchors and buoy systems. The larger the study area and more robust the coverage (overlapping detection ranges), the higher the initial investment will be. Even though battery life of the tags can range from three to five years, it may prove beneficial to repeat tagging efforts each year to provide a larger dataset for analysis. However that choice is optional. Once the receiver equipment is purchased and tags are implanted, SAIC will be able to monitor the area for multiple years without needing to purchase additional equipment. Ultimately, the number of tagged fish will dependent on the desired level of statistical confidence and fish availability during tagging efforts. See Table 2 for a list of prices for these components.

Table 2. Acoustic Telemetry Equipment

TRANSMITTERS	USD
V5 pinger (coded - 180 kHz)	357.60
V6 pinger (coded - 180 kHz)	357.60
V7 pinger (coded - 69 kHz)	357.60
V8 pinger (coded - 69 kHz)	357.60
V9 pinger (coded or continuous 63-84 kHz)	357.60
V13 pinger (coded or continuous 60-84kHz)	337.16
V16 pinger (coded or continuous 51-84kHz)	337.16
V9T temperature (coded or continuous 63-84kHz)	490.42
V9P depth (coded or continuous 63-84kHz)	592.59
V9TP temperature & depth (coded or continuous 63-84kHz)	674.32
V9A - accelerometer (coded 69kHz)	602.80
V9AP - accelerometer & depth (coded 69kHz)	704.97

TRANSMITTERS	USD
V13T temperature (coded or continuous 60-84kHz)	490.42
V13P depth transmitter (coded or continuous 60-84kHz)	592.59
V13TP temperature & depth (coded or continuous 63-84kHz)	674.32
V13A temperature & depth (coded 69kHz)	602.80
V13AP temperature & depth (coded 69kHz)	704.97
V16T temperature (coded or continuous 51-84kHz)	490.42
V16P depth (coded or continuous 51-84kHz)	725.41
V16TP temp and depth (coded or continuous 51-84kHz)	796.93
VR100 Manual Tracking Receiver (51 – 81 kHz)	5,900.00
VR2W @ 69 kHz	1,491.68
VR2W coded underwater receiver@ 69 kHz; 8 MEG RAM non-volatile data storage (1,000,000 detections); includes lithium battery (requires handling fee); approx. 15 months battery life; Bluetooth communications	
VR2W @ 180 kHz	1,685.81
VR2W coded underwater receiver@ 180 kHz; 8 MEG RAM non-volatile data storage (1,000,000 detections); includes lithium battery (requires handling fee); approx. 8 months battery life; Bluetooth communications	
VR2W Receiver battery	30.00

VI. Please provide the anticipated results of the project, and whether it is included in a City of Port St. Joe, City of Wewahitchka or Gulf County Comprehensive and Mitigation Plan?

The results of this project will equip Gulf County with a better understanding of how the current natural and artificial reefs are being inhabited and utilized. Since this would be the first assessment of this area in the Gulf, the information would serve as a baseline for future management decisions. Specifically, the findings from this project could help clarify the role artificial reefs play in supplementing the natural reef habitats as it pertains to fisheries management and stock assessments. It could also dictate the placement of future artificial reefs within existing permitted sites. Gulf County will also be able to assess the functionality of existing reef structures and provide meaningful monitoring data to the permitting authorities. Furthermore, information on utilization and movements of fish species on natural and artificial reef structures within the study area would allow for comparisons of the efficacy of different reef designs for attracting and retaining specific reef fish species.

By targeting a variety of reef fish species from different age classes, evidence of utilization of these areas can be documented and potentially incorporated into fish stock assessments. Example questions that could in answered include: Do the reefs in this area of the Gulf provide adequate refuges for juveniles? Are the adults migrating to areas outside the study area or are they exhibiting a high level of site fidelity? Are the reefs primarily being used by adults only? Is the existing natural and artificial reef network contributing to a life history "bottleneck" effect, where only one or two life stages are supported in these areas such that adding more reefs would only increase fishing mortality instead of growing the population? The answers to these questions and others like it will have a significant impact on how future artificial reefs should be designed, configured, and deployed in the future. Monitoring a large natural and artificial reef area will also help determine whether that it has exceeded its carrying capacity or if additional reefs should be deployed. Furthermore since the battery life of the tags range from three-to-five

years, it will allow for long-term monitoring of these species, providing an opportunity for continuous data collection that can either validate or clarify findings from the baseline study. Understanding the level of large-scale movement, site fidelity, and usage of the existing reef network will provide insight into what types of reef designs or configurations will best support a growing fishery stock or improve conditions for a declining fishery stock. For the first time, there can be a scientific approach to incorporating artificial reefs into fisheries management and conservation, while still satisfying the needs of recreational/commercial fishermen and divers.

The findings of this study will indirectly satisfy objectives outlined in the Comprehensive Plans for Gulf County (Chapter 6, Objective 1.4) and the City of Port St. Joe (Section II. B. Conservation, Objective 1.4) which call for them to conserve, protect, and appropriately use its natural resources including fisheries, wildlife, wildlife habitat, marine habitat, minerals, soils, and native vegetative communities. More importantly, this project will respond directly to the City of Port St. Joe's Resolution 2010-04 directed to the State Congress to delegate funding to the NMFS for new stock assessments to be conducted that would correct previous assessments that have been found to be "fatally flawed" by the National Research Council and have resulted in the shut-down of specific fisheries. Specifically, the City "requests support for the establishment of a near real-time data collection system, and the associated update of the Magnuson-Stevens Fishery Management Act so that faith and accountability can be restored it its scientific and management procedures." The acoustic telemetry technology described in this proposal is a "real-time data collection system" and can be a powerful fisheries management tool that has the potential to mend the relationship between local fishermen, regulators, and the scientific community.

REFERENCES

Campbell, M.D., K. Rose, K. Boswell, and J. Cowan, 2011. Individual-based modeling of an artificial reef community: effects of habitat quantity and degree of refuge. *Ecological Modelling* 222: 3895-3909.

Erickson, D.L., and M.A.H. Webb. 2007. Spawning periodicity, spawning migration, and size at maturity of green sturgeon, *Acipenser medirostris*, in the Rogue River, Oregon. *Environmental Biology of Fishes* 79:255-268.

Submitted By:

Signature Date: 28 February 2013
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Telephone Number: 850-609-3418
E-mail Address (if applicable): mckeew@saic.com

PUBLIC RECORDS POLICY AND PUBLIC ACCESS ACKNOWLEDGMENT FOR GULF COUNTY RESTORE ACT APPLICANTS

I, W. James McKee, the undersigned authority and/or representative of the entity, Science Applications International Corporation and or the individual who has submitted the Gulf County RESTORE Act Proposal/Pre-Proposal titled "Acoustic Telemetry Study and Data Analysis to Monitor Reef Fish Species Movements in the Gulf of Mexico Offshore of Gulf County, Florida" hereby acknowledge, consent and accept the following representations that coincide with my/our submission for consideration, evaluation and possible recommendation and approval by the Gulf County Board of County Commissioners for funding from the RESTORE Act distribution that strictly complies with the guidelines and regulations set forth under the Restoration and Ecosystems Sustainability, Tourist Opportunities and Revived Economies of the Gulf Coast States Act of 2012:

1. I/We am the authorized representative of the application/pre-proposal referenced above.
2. I/We have thoroughly reviewed and familiarized myself and/or my entity on which I have submitted the application/pre-proposal on behalf of with the entirety of the Gulf County Public Records policy.
3. I/We have thoroughly reviewed and familiarized myself and/or my entity on which I have submitted the application/pre-proposal on behalf of with the entirety of the Florida Statute Chapter 119 which controls and permits public access to information.
4. I/We hereby acknowledge, consent and agree to the controlling policies and statutes above as well as the free and open exchange of any and all submissions provided hereunder this application/pre-proposal and all information exchanged hereafter including but not limited to further amendments to these proposals as well as surveys, studies, research, data production, books, drawings, property records, work papers, county owner lists, files, forms, reports, accounts, documents, manuals, handbooks, instructions, printouts relating in any manner for the production of the application. In addition, all papers, notes, data, reference material, documentation, programs, printouts, and all other media and forms of expression that in any way include, incorporate or reflect any confidential information of what ultimately shall become the Gulf County plans for use and application of the RESTORE Act funding.
5. I/We acknowledge, agree and fully consent to cooperate with the appointed Gulf County RESTORE ACT committee, county officials and staff as a continuing obligation and condition of final review for this RESTORE Act application/pre-proposal.
6. I/We have submitted this acknowledgment to Gulf County RESTORE Act Committee and the Gulf County Board of County Commissioners for the purpose and intent of receiving an evaluation, review and possible recommendations for anticipated funding from the Restoration and Ecosystems Sustainability, Tourist Opportunities and Revived Economies of the Gulf Coast States Act of 2012.

Date: _3/5/203

Signature of RESTORE Act Applicant

___W. James McKee